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(54) POLYESTER COMPOSITE FIBER FOR
STRETCHABLE FABRIC

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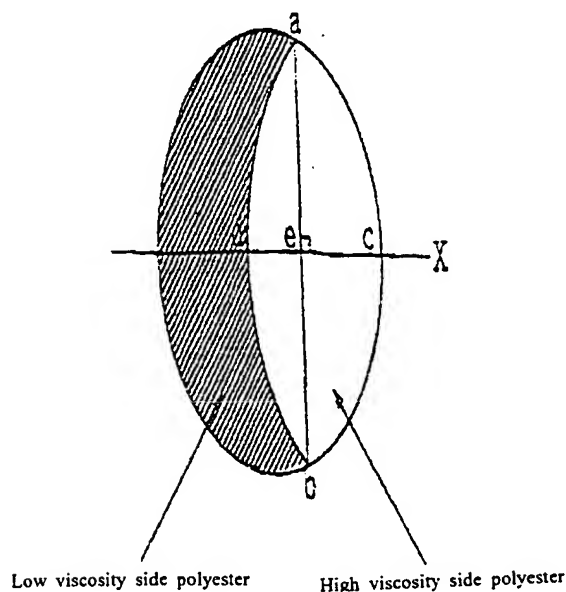
[Abstract]

[Problem] To provide a polyester composite fiber for stretchable fabrics which are rich in bulkiness and have a soft feeling that has never been obtained before.

[Means for the Solution] It is a fiber in which two types of polyesters having different limiting viscosities are compounded in the mutually side-Japanese Kokai Patent No: P 2000-239927A

by-side type, and the shape of the composition plane of both polyesters of the fiber cross section is a curvature. In this fiber, when the intersection point of the high viscosity side polyester fiber outer circumference and straight line X, which is perpendicular to line ab and passes through the center of line ab that joins two contact points, a and b, of the composition plane and the fiber outer circumference, is set to c, the intersection point of the composition plane and straight line X is set to d, and the intersection point of line cd and line ab is set to e, the length ratio de/cd of line de to line cd satisfies the following formula (1), and Young's modulus of the yarn is 40 g/D or lower and crimping is 30 % or higher.

$$0.05 \leq de/cd \leq 0.80 \quad (1)$$



[Claims]

[Claim 1] A polyester composite fiber for stretchable fabrics characterized by the fact that it is a fiber in which two types of polyesters having different limiting viscosities are compounded in the mutually side-by-side type, and the shape of the composition plane of both polyesters of the fiber cross section is a curvature; and also that when the intersection point of the high viscosity side polyester fiber outer circumference and straight line X, which is perpendicular to line ab and passes through the

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center of line ab that joins two contact points, a and b, of the composition plane and the fiber outer circumference, is set to c, the intersection point of the composition plane and straight line X is set to d, and the intersection point of line cd and line ab is set to e, the length ratio de/cd of line de to line cd satisfies the following formula (1), and Young's modulus of the yarn is 40 g/D or lower and crimping is 30 % or higher.

$$0.05 \leq de/cd \leq 0.80 \quad (1)$$

[Claim 2] The polyester composite fiber for stretchable fabrics as described in Claim 1 in which the two types of polyesters are the polytrimethylene terephthalate having 85 % or higher of the repeating unit of trimethylene terephthalate

[Detailed Description of the Invention]

[0001]

[Technical Field of the Invention] The present invention relates to a polyester composite fiber for stretchable fabrics which are rich in bulkiness and have a soft feeling that has never been obtained before.

[0002]

[Prior Art] The fact that in order to obtain stretchable fabrics the composite fiber having latent crimping in which two types of polyesters with different limiting viscosities are joined in the side-by-side type are used is well-known. When this composite fiber with latent crimping is subject to the crimping treatment in the yarn or fabric state to allow it to crimp, and it is utilized as the fabric provided with stretchability, the three dimensional crimp or crimping ability of the yarn greatly affects stretchability of the resultant fabric.

[0003] Conventionally, in order to obtain such a polyester composite fiber with latent crimping, the difference between the two polyester limiting viscosities is maximized and the difference in shrinkage upon making a fiber is enlarged. Furthermore, in order to improve spinning operability, attempts are made to make linear the composition plane of both polyesters of the fiber cross section. Thus, various proposals are made on these composite fibers.

[0004] For instance, when the limiting viscosity difference between two types of polyesters is large, the discharged yarn bends at the time of melt spinning. Moreover, when the limiting viscosity difference becomes much greater, the bending advances excessively, the yarn adheres to the spinning nozzle to cause breakage, and stable spinning cannot be carried out. Consequently, for a nozzle which allows polymers having different viscosities to be discharged from a pair of discharging holes to form a composite fiber of the side-by-side type, proposed is a nozzle for melt spinning which specifies each angle of inclination formed by a pair of discharging holes with respect to the direction perpendicular to the nozzle plane, or the distance between a pair of discharging holes (Japanese Examined Patent Sho 61 (1986)-60163).

[0005] When spinning is carried out with this melt spinning nozzle, the composition plane of two types of polyester in the fiber cross section

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becomes linear. In this case, even though the limiting viscosity difference between two types of polyesters is large, the spinning operability is good. Since the composition plane of two types of polyesters is linear, the three dimensional crimp form of the exhibited crimp is small and a great many crimps per unit length are developed. Therefore, fitting between two single yarns occurs, and when fabrics are made a flat feeling that lacks bulkiness is entailed.

[0006]

[Problems to be Solved by the Invention] The technical task of the present invention is to solve the above-mentioned problems, and to provide a polyester composite fiber for stretchable fabrics that are rich in buliness and have a soft feeling unobtainable in the past.

[0007]

[Means to Solve the Problems] The present inventor carried out research zealously in order to solve the above-mentioned problems. As a result, the present inventor found that, when the composite plane shape of two polyesters in the fiber cross section was allowed to curve within a specific range, and Young's modulus of the yarn was allowed to be within a specific range, a polyester composite fiber that could impart simultaneously bulkiness, a soft feeling unobtainable in the past and stretchability to the fabrics produced could be obtained. Thus the present invention was achieved.

[0008] Namely, the gist of the present invention is a polyester composite fiber for stretchable fabrics characterized by the fact that it is a fiber in which two types of polyesters having different limiting viscosities are compounded in the mutually side-by-side type, and the shape of the composition plane of both polyesters of the fiber cross section is a curvature; and also that when the intersection point of the high viscosity side polyester fiber outer circumference and straight line X, which is perpendicular to line ab and passes through the center of line ab that joins two contact points, a and b, of the composition plane and the fiber outer circumference, is set to c, the intersection point of the composition plane and straight line X is set to d, and the intersection point of line cd and line ab is set to e, the length ratio de/cd of line de to line cd satisfies the following formula (1), and Young's modulus of the yarn is 40 g/D or lower and crimping is 30 % or higher.

$$0.05 \leq de/cd \leq 0.80 \quad (1)$$

[0009]

[Embodiment and Form of the Invention] The present invention is described in detail in the following.

[0010] The composite fiber of the present invention is a fiber in which two types of polyesters are joined mutually in the side-by-side type, and the composition plane shape of two types of polyesters in the fiber cross section must be a curvature. When the composition plane of two types of polyesters in the fiber cross section is linear, the three dimensional crimp form developed by the shrinkage treatment becomes small, and a great many

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crimps per unit length are exhibited. Hence fitting between two single yarns occurs, and the bulkiness of fabrics decreases.

[0011] Figure 1 is a cross sectional drawing showing one embodiment form of the composite fiber of the present invention. In Figure 1, the intersection point of the high viscosity side polyester fiber outer circumference and straight line x, which is perpendicular to line ab and passes through the center of line ab that joins two contact points, a and b, of the composition plane of two polyesters and the fiber outer circumference, is set to c, the intersection point of the composition plane and straight line x is set to d, and the intersection point of line cd and line ab is set to e. In the composite fiber of the present invention, the length ratio of line de to line cd (henceforth, de/cd) must be $0.05 \sim 0.8$ as shown in the afore-mentioned formula (1). When this ratio is below 0.05, the composition plane of two esters of the fiber cross section becomes linear and the bulkiness of fabrics becomes low. On the other hand, when this ratio exceeds 0.80, while the three dimensional crimp form of the crimp developed with the shrinkage treatment becomes large, in order to render this ratio greater than 0.80 the limiting viscosity difference between two polyesters must be made greater. Therefore, problems arise that the discharged yarn bends and adheres to the nozzle plane at the time of melt spinning, hence the yarn breakage occurs and stable spinning cannot be carried out.

[0012] Moreover, in the composite fiber of the present invention, Young's modulus of the yarn must be 40 g/D or lower. When the Young's modulus of the yarn is greater than 40 g/D the fabric made gives a stiff feeling and lacks a soft feeling. There is no particular limitation to a method to form the Young's modulus of 40 g/D or lower. For instance, the method to constitute the yarn with a polyester having a relatively soft structure is preferable. Among the polyesters, suitable is polytrimethylene terephthalate (henceforth, called PTT) superior in stretchability, dimensional stability and light resistance.

[0013] As long as the effect of the present invention is not impaired, even if a small amount of a copolymerizing component is contained there is no particular problem. Named for the copolymerizing component are aromatic dicarboxylic acid components such as 5 - sodiosulfoisophthalic acid, isophthalic acid, phthalic anhydride and naphthalenedicarboxylic acid; aliphatic dicarboxylic acid components such as adipic acid, sebacic acid and azelaic acid; hydroxycarboxylic acid components such as 4-hydroxybenzoic acid and ϵ -caprolactone; and diol components such as ethylene glycol, 1,4-butanediol, 1,4-cyclohexanedimethanol and ethylene oxide adduct of 2,2-bis[4-(β -hydroxy)phenyl] propane.

[0014] Furthermore, in the composite fiber of the present invention, the crimping when the yarn is subject to the shrinkage treatment with boiling water must be 30 % or higher. If crimping is lower than 30 %, the fabric obtained with this fiber lacks stretchability and the fabric is unsuitable for stretchable fabrics. For a method to form crimp of no less than 30 %, a method to adjust the limiting viscosity difference between two polyesters is

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preferable. And in order to make the crimp of the composite fiber 30 % or higher preferable is to use a polyester having the limiting viscosity of 0.6 ~ 1.10 for the low limiting viscosity side, and a polyester having the limiting viscosity of 0.7 ~ 1.30 for the high limiting viscosity side, and to combine them so as to form a limiting viscosity difference of no less than 0.1 between two polyesters.

[0015] As long as the effect of the present invention is not impaired, a matting agent such as titanium oxide, antioxidant such as a hindered bisphenol type compound, UV light absorbent, light stabilizer, pigment, fire retardant, antimicrobial agent and conductivity imparting agent may also be added as needed.

[0016] Next, a preparative method for the composite fiber of the present invention is described. First, two types of polyesters having mutually different limiting viscosities are melted with the composite spinning equipment, measured at separate measuring holes, allowed to combine at the back of the nozzle so as to form the side-by-side type and discharged at the spinning temperature of 240 ~ 290°C from the same discharging hole, and the spun yarn is cooled. Afterward, oil is added, and the yarn is taken up at a rate of 1000 ~ 4000 m/min. Subsequently, the drawing/twisting machine is used to carry out the drawing heat treatment to obtain the composite fiber of the present invention.

[0017]

[Examples of Embodiment] The present invention is described concretely with the examples of embodiment in the following. The present invention is not limited to these examples, however. The measurement methods and evaluation methods in the examples are described in the following.

(1) Limiting viscosity $[\eta]$

A mixture of phenol and tetrachloroethane in equal proportions was used as solvent and the viscosity was measured at 25°C.

(2) Crimping

The composite fiber multifilament obtained is reel-wound 5 times with a sizing reel having a circumference of 1.125 m to be doubled, and left standing for 30 min under the load of 1/6000 g/D. Subsequently, it is treated with boiling water for 30 min as the load is applied on it, and the sample after the treatment is dried for 30 min. A load of 1/500 g/D is applied on the dried sample, and length A is measured. Subsequently, the load of 1/500 g/D is removed, a load of 1/20 g/D is applied to measure length B and crimping is calculated from the following formula.

$$\text{Crimping (\%)} = [(B-A)/B] \times 100$$

(3) Evaluation of spinning operability

Evaluation was made by the number of yarn breakages when spinning was carried out with 16 spindles for 24 hrs. O and Δ were deemed as the basis for acceptance. O time: O, 1-2 times: Δ, 3 times or more: X

(4) Evaluation of stretchability and feeling

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A polyethylene terephthalate (henceforth, called PET) drawn yarn having 50 denier/2 filaments was used as the warp, and the composite fiber obtained was used as the woof to make a fabric of plain weave. After this (incomprehensible word) was refined, it was treated with boiling water at 100°C for 30 min followed by air drying. Subsequently, the fabric obtained was subject to a function evaluation by a 10 member panel. The evaluation was made on the basis of the number of panelists who judged that it had bulkiness and a soft feeling, and O and Δ were deemed as the basis for acceptance.

9 panelists or more: O, 7-8 panelists:Δ, 6 panelists or fewer: X

(5) Overall evaluation

Taking each of the above-mentioned evaluation items into consideration, the overall evaluation was made with O, Δ and X, and O and Δ were deemed as the basis for acceptance.

[0018] Example 1

Each of high viscosity side PTT (A) containing 0.4 % by weight of titanium oxide and having a limiting viscosity of 1.01, and low viscosity side PTT (B) containing 0.4 % by weight of titanium oxide and having a limiting viscosity of 0.78 was melted, and the discharging ratio was adjusted so that the volume ratio of the fiber cross section of PTT (A) to that of PTT (B) would become 1 : 1 to carry out spinning at the spinning temperature of 260°C from the same spinning nozzle having 24 round cross section-shaped holes with a hole diameter of 0.6 mm.

[0019] Subsequently, after the spun yarn was cooled and solidified with the airstream, 0.7 % by weight of oil was imparted, the yarn was divided in two and taken-up at a rate of 2800 m/min to obtain a 82.5 denier semi-undrawn yarn of the side-by-side type. The discharging volume at this juncture was adjusted so as to form the post-drawing size of 50 denier. Subsequently, after the semi-undrawn yarn was drawn to 1.65 fold at 70°C, a heat treatment was carried out on a hot plate at 160°C to obtain a composite fiber of 50 denier / 12 filaments.

[0020] Examples 2 ~ 3, Comparative Examples 1 ~ 2

In order to change de/cd in the fiber cross section the limiting viscosity of PTT (B) was changed as shown in Table 1. Otherwise, a composite fiber was prepared in the same way as Example 1.

[0021] Example 4, Comparative Example 3

In order to change de/cd, the ethylene oxide adduct of 2,2-bis[4-(β-hydroxy)phenyl] propane was copolymerized, as the third component, in the amount of 5 mole % for Example 4 and 2 mole % for Comparative Example 2 with PTT (A) to form limiting viscosity differences from PTT (B) as shown in Table 1. Otherwise, a composite fiber multifilament was prepared in the same way as Example 1.

[0022] Comparative Example 4

Each of high viscosity side PTT (A) containing 0.4 % by weight of titanium oxide and having a limiting viscosity of 0.67, and low viscosity side PTT (B)

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containing 0.4 % by weight of titanium oxide and having a limiting viscosity of 0.46 was melted, and the discharging ratio was adjusted so that the volume ratio of the fiber cross section of PTT (A) to that of PTT (B) would become 1 : 1 to carry out spinning at the spinning temperature of 295°C from the same spinning nozzle having 24 round cross section-shaped holes with a hole diameter of 0.8 mm.

[0023] Subsequently, after the spun yarn was cooled and solidified with the airstream, 0.7 % weight of oil was imparted, the yarn was divided in two and taken-up at a rate of 3300 m/min to obtain a 75 denier semi-undrawn yarn of the side-by-side type. The discharging volume at this juncture was adjusted so as to form the post-drawing size of 50 denier. Furthermore, the semi-undrawn yarn obtained was drawn at 70°C to 1.5 fold followed by a heat treatment on a hot plate at 150°C to obtain a composite fiber of 50 denier / 12 filaments. The evaluation results on the composite fiber multifilaments obtained in Examples 1 ~ 4 and Comparative Examples 1 ~ 4 are shown jointly in Table 1

[0024]

Table 1

	Limiting viscosity		d e / c d	Spinning operability	Stretchability and feeling	Young's modulus (g/D)	Crimping (%)	Overall evaluation
	A	B						
Ex. 1	1.01	0.78	0.48	○	○	23.6	52.4	○
Ex. 2	1.01	0.88	0.19	○	△	25.1	39.9	○
Ex. 3	1.01	0.71	0.78	△	○	22.3	65.8	○
Ex. 4	1.03	1.01	0.36	○	○	34.4	55.7	○
Comp. Ex. 1	1.01	0.66	Spinning, impossible					×
Comp. Ex. 2	1.01	0.98	0.04	○	×	26.1	22.6	×
Comp. Ex. 3	1.03	1.01	0.03	○	×	30.7	40.8	×
Comp. Ex. 4	0.67	0.46	0.54	○	×	50.3	44.7	×

[0025] It is evident from Table 1 that the composite fiber multifilaments obtained in Examples 1 ~ 4 had few yarn breakages during spinning, and the fabrics after the heat treatment in which these composite fiber multifilaments were used for the wool had stretchability in the cross direction, bulkiness and a soft feeling. Moreover, the crimping which was used as the barometer of stretchability was also 30 % or higher. Furthermore, the Young's modulus which was used as the barometer of soft feeling was also 40 g/D or lower, and the correlation with the function evaluation on fabrics was very significant.

[0026] On the other hand, in Comparative Example 1, since the limiting viscosity difference between two polyesters was too large, during melt spinning the discharged yarn bent and adhered to the nozzle plane rendering spinning impossible. Moreover, in Comparative Example 2, since de/cd was too small the three dimensional crimp form became small, the

fabric lacked bulkiness and the crimping value was also low. In Comparative Example 3, because a third component was copolymerized with PTT (A) the crimping value was appropriate, but because de/cd was too small the crimp form became small and the fabric lacked bulkiness. Furthermore, in Comparative Example 4, because of the use of PET the fabric gave a stiff feeling and a fabric with a soft feeling could not be obtained. Moreover, the Young's modulus was also higher than 40 g/D.

[0027]

[Effect of the Invention] The present invention provides a polyester composite fiber for stretchable fabrics which gives a stretchable fabric that is rich in bulkiness, and has a soft feeling.

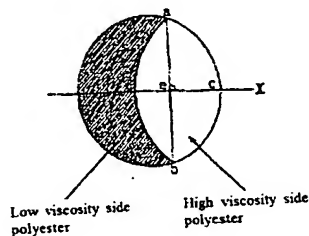
[Brief Description of the Drawing]

[Figure 1] It is a cross sectional drawing to show one form of embodiment of the polyester composite fiber for stretchable fabrics of the present invention.

[Explanation of Symbols]

- a Contact point of composition plane of two polyesters and fiber circumference
- b Contact point of composition plane of two polyesters and fiber circumference
- X Straight line that passes through the center of line ab and is perpendicular to line ab
- c Intersection point of straight line X and the fiber circumference of the high viscosity side polyester
- d Intersection point of straight line X and the composition plane of two polyesters
- e Intersection point of line ab and straight line X

Figure 1



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(54) **POLYESTER CONJUGATE FIBER FOR
STRETCHABLE WOVEN OR KNITTED FABRIC**

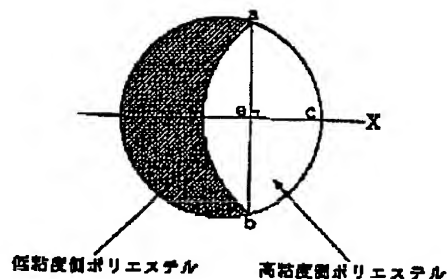
(57) Abstract:

PROBLEM TO BE SOLVED: To provide a polyester conjugate fiber which has rich bulkiness, is useful for a stretchable woven or knitted fabric, and forms the stretchable woven or knitted fabric having a new soft touch.

SOLUTION: This polyester conjugate fiber is obtained by combining two kinds of polyesters having different intrinsic viscosities, respectively, into a side-by-side type where the joined surface of both the polyesters is curved in the cross section of the conjugate fiber. The conjugate fiber has a fiber Young's modulus of ≤ 40 g/D and a crimp percent of $\approx 30\%$ and satisfies the following inequality: $0.05 \leq de/cd \leq 0.80$, wherein c is a cross point between the fiber outer periphery of the high viscosity side polyester and a straight line X which passes through the center of a line ab binding two contact points a, b between the joined surface and the outer periphery of the conjugated fiber and crosses the line ab; d is a cross point

between the joined surface and the straight line X; and e is a cross point between the line cd and the line ab; de/cd is the ratio of the length of the line de to the length of the line cd.

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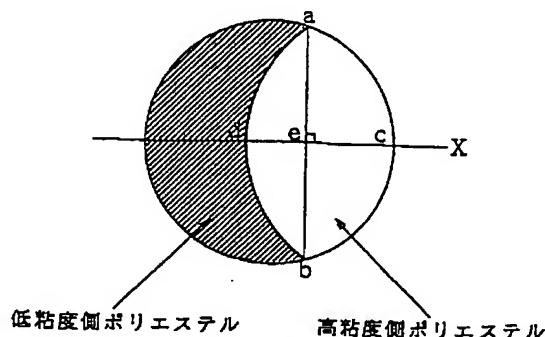
(54)【発明の名称】 ストレッチ性繊維物用ポリエステル複合繊維

(57)【要約】

【課題】 高粘性に富み、従来にないソフトな風合を有するストレッチ性繊維物となるストレッチ性繊維物用ポリエステル複合繊維を提供する。

【解決手段】 極限粘度の異なる2種類のポリエステルが、互いにサイドバイサイド型に複合され、繊維横断面の両ポリエステルの接合面形状が湾曲している繊維である。この繊維は、接合面と繊維外周との2つの接点a、bを結んだ線分abの中心を通り、線分abと直交した直線Xと高粘度側ポリエステルの繊維外周との交点をc、接合面との交点をd、線分cdと線分abとの交点をeとしたとき、線分deと線分cdとの長さの比 $d e / c d$ が下記式(1)を満足し、かつ、糸条のヤング率が $40 g / D$ 以下、捲縮率が30%以上である。

$$0.05 \leq d e / c d \leq 0.80 \quad (1)$$



【特許請求の範囲】

【請求項1】 極限粘度の異なる2種類のポリエステルが、互いにサイドバイサイド型に複合され、繊維横断面の両ポリエステルの接合面形状が湾曲している繊維であり、接合面と繊維外周との2つの接点a、bを結んだ線分abの中心を通り、線分abと直交した直線Xと高粘度側ポリエステルの繊維外周との交点をc、接合面との交点をd、線分cdと線分abとの交点をeとしたとき、線分deと線分cdとの長さの比 $d e / c d$ が下記式(1)を満足し、かつ、糸条のヤング率が $40 \text{ g} / \text{D}$ 以下、捲縮率が30%以上であることを特徴とするストレッチ性繊維物用ポリエステル複合繊維。

$$0.05 \leq d e / c d \leq 0.80 \quad (1)$$

【請求項2】 2種類のポリエステルがトリメチレンテレフタレート繰返し単位が85%以上のポリトリメチレンテレフタレートである請求項1記載のストレッチ性繊維物用ポリエステル複合繊維。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、嵩高性に富み、従来にはないソフトな風合いを有するストレッチ性繊維物用のポリエステル複合繊維に関するものである。

【0002】

【従来の技術】ストレッチ機能を有する繊維物を得るために、極限粘度の異なる2種類のポリエステルのサイドバイサイド型に接合した潜在捲縮性の複合繊維を使用することはよく知られている。この潜在捲縮性複合繊維に糸条や繊維物の状態で捲縮発現処理を施して捲縮を発現させ、ストレッチ性能を具備する繊維物として利用する際には、糸条の3次元クリンプ形態や捲縮性能が布帛にしたときのストレッチ性能に大きく影響する。

【0003】従来、このような潜在捲縮性ポリエステル複合繊維を得るために、両ポリエステルの極限粘度差を可能な限り大きくし、繊維にしたときの収縮差を大きくしており、さらには、紡糸操業性を向上させるために、繊維横断面の両ポリエステルの接合面を直線的にする努力がなされており、これらの複合繊維について種々の提案がなされている。

【0004】例えば、2種類のポリエステルの極限粘度差が大きい場合などは、熔融紡糸時に吐出糸条が屈曲を起こす。また、極限粘度差がさらに大きくなると、屈曲が過度に進み、糸条が紡糸口金に付着して切断が生じ、安定して紡糸を行うことができない。そこで、粘度の異なるポリマーを一對の吐出孔から吐出させて、サイドバイサイド型の複合繊維を形成するようにした口金において、1対をなす吐出孔が口金面と直交する方向に対してなす各々の傾斜角度や、1対の吐出孔間の距離等を規制した熔融紡糸用口金（特公昭61-60163号公報）が提案されている。

【0005】この熔融紡糸用口金を用いて紡糸すると、

繊維横断面における2種類のポリエステルの接合面は直線的になる。この場合、2種類のポリエステルの極限粘度差が大きいても紡糸操業性は良好であるが、2種類のポリエステルの接合面が直線的であるため、発現する捲縮の3次元クリンプ形態が小さく、単位長さあたりに捲縮が非常に多く発現するため、単糸同士にはまり込みが発生し、繊維物にしたときに嵩高性に欠けたフラットな風合になるという問題があった。

【0006】

【発明が解決しようとする課題】本発明は、上記の問題を解消し、製編織すれば、嵩高性に富み、従来にはないソフトな風合を有するストレッチ性繊維物となるストレッチ性繊維物用ポリエステル複合繊維を提供することを技術的な課題とするものである。

【0007】

【課題を解決するための手段】本発明者らは、上記の課題を解決するために鋭意研究した結果、繊維横断面における両ポリエステルの接合面形状を特定の範囲内で湾曲させ、かつ、糸条のヤング率を特定の範囲内にすることにより、製編織して得られる布帛に、嵩高性、従来にはないソフトな風合、ストレッチ性を同時に付与することができるポリエステル複合繊維が得られることを知見して本発明に到達した。

【0008】すなわち、本発明は、極限粘度の異なる2種類のポリエステルのサイドバイサイド型に複合され、繊維横断面の両ポリエステルの接合面形状が湾曲している繊維であり、接合面と繊維外周との2つの接点a、bを結んだ線分abの中心を通り、線分abと直交した直線Xと高粘度側ポリエステルの繊維外周との交点をc、接合面との交点をd、線分cdと線分abとの交点をeとしたとき、線分deと線分cdとの長さの比 $d e / c d$ が下記式(1)を満足し、かつ、糸条のヤング率が $40 \text{ g} / \text{D}$ 以下、捲縮率が30%以上であることを特徴とするストレッチ性繊維物用ポリエステル複合繊維を要旨とするものである。

$$0.05 \leq d e / c d \leq 0.80 \quad (1)$$

【0009】

【発明の実施と形態】以下、本発明について詳細に説明する。

【0010】本発明の複合繊維は、極限粘度の異なる2種類のポリエステルのサイドバイサイド型に接合された繊維であり、かつ、繊維横断面における2種類のポリエステルの接合面形状が湾曲している必要がある。繊維横断面における2種類のポリエステルの接合面が直線的であると、収縮処理によって発現する捲縮の3次元クリンプ形態が小さくなり、単位長さあたりに捲縮が非常に多く発現するため、単糸同士にはまり込みが発生する。このため、繊維物の嵩高性が低くなる。

【0011】図1は、本発明の複合繊維の一実施態様を示す横断面図である。図1において、両ポリエステルの

接合面と繊維外周との2つの接点a、bを結んだ線分abの中心を通り、線分abと直交する直線Xと高粘度側ポリエステル繊維外周との交点をc、接合面との交点をdとし、線分cdと線分abとの交点をeとする。本発明の複合繊維は、線分deと線分cdとの長さの比（以下、 de/cd ）を前記(1)式のように0.05～0.80とする必要がある。この比が0.05未満になると、繊維横断面の両ポリエステルの接合面が直線的になり、繊維物の高刚性は低いものとなる。一方、この比が0.80を超えると、収縮処理によって発現する捲縮の3次元クリンプ形態は大きくなるが、この比を0.80を超えるようにするためには、両ポリエステルの極限粘度差を大きくする必要がある。溶融紡糸時に吐出糸条が屈曲して口金面に付着し、このため、糸条の切断が生じて安定した紡糸ができなくなるという問題が生じる。

【0012】また、本発明の複合繊維は、糸条のヤング率が40g/D以下である必要がある。糸条のヤング率が40g/Dより大きくなると、繊維物にしたときの風合いが硬くなり、ソフト感に欠けたものとなる。ヤング率を40g/D以下とする方法は特に限定されるものではないが、例えば、糸条を比較的柔軟な構造のポリエステルで構成させる方法が好ましい。中でも、伸縮性、寸法安定性、耐光性に優れたポリトリメチレンテレフタレート（以下、PTTと略称する。）が好適である。

【0013】なお、本発明の効果を損なわない限り、少量の共重合成分が含有されていても特に問題はなく、共重合成分としては、5-ナトリウムスルホイソフタル酸、イソフタル酸、無水フタル酸、ナフタレンジカルボン酸等の芳香族ジカルボン酸成分、アジピン酸、セバシン酸、アゼライン酸等の脂肪族ジカルボン酸成分、4-ヒドロキシ安息香酸、ε-カプロラクトン等のヒドロキシカルボン酸成分、エチレングリコール、1,4-ブタンジオール、1,4-シクロヘキサジメタノール、2,2-ビス〔4-(β-ヒドロキシ)フェニル〕プロパンのエチレンオキシド付加体等のジオール成分等が挙げられる。

【0014】さらに、本発明の複合繊維は、沸水で糸条を収縮処理したときの捲縮率が30%以上である必要がある。捲縮率が30%より低いと、この繊維から得られる繊維物のストレッチ性が乏しくなり、ストレッチ性繊維物用には適さない。捲縮率を30%以上にする方法としては、両ポリエステル間の極限粘度差を調整する方法が好ましい。そして、複合繊維の捲縮率を30%以上にするためには、低極限粘度側に0.6～1.10の極限粘度を有するポリエステル、高極限粘度側に0.7～1.30の極限粘度を有するポリエステルを使用し、両ポリエステル間の極限粘度差が0.1以上となるように組み合わせることが好ましい。

【0015】本発明の複合繊維中には、本発明の効果を

損なわない限り、必要に応じて酸化チタンなどの艶消し剤、ヒンダートフェノール系化合物等の酸化防止剤、紫外線吸収剤、光安定剤、顔料、難燃剤、抗菌剤、導電性付与剤等を配合してもよい。

【0016】次に、本発明の複合繊維の製法例について説明する。まず、複合紡糸装置を用いて、互いに異なる極限粘度の2種類のポリエステルを溶融して別々の計量孔で計量し、口金背面でサイドバイサイド型になるように合流させ、紡糸温度240～290℃で同一吐出孔から吐出させ、紡出糸条を冷却した後、油剤を付与して1000～4000m/分の速度で引取り、捲取る。次いで、延燃機を用いて延伸熱処理を行い、本発明の複合繊維を得る。

【0017】

【実施例】次に、本発明を実施例によって具体的に説明するが、本発明は、これらの実施例に限定されるものではない。なお、実施例における測定方法および評価方法は次の通りである。

(1) 極限粘度〔 η 〕

フェノールと四塩化エタンの等量混合物を溶媒とし、温度25℃で測定した。

(2) 捲縮率

得られた複合繊維マルチフィラメントを外周1.125mの検尺機で5回かせ取りして2重にし、1/6000g/Dの荷重をかけて30分間放置する。次いで、荷重をかけたままの状態では30分間沸水処理し、処理後の試料を30分間乾燥する。乾燥した試料に1/500g/Dの荷重をかけ、長さAを測定する。次いで、1/500g/Dの荷重を外し、1/20g/Dの荷重をかけて長さBを測定し、次式で算出する。

$$\text{捲縮率 (\%)} = [(B - A) / B] \times 100$$

(3) 紡糸操作性評価

16锤で24時間の紡糸を行った時の切糸回数で評価し、○及び△を合格基準とした。

0回：○、1～2回：△、3回以上：×

(4) ストレッチ性と風合の評価

経糸に50デニール/24フィラメントのポリエチレンテレフタレート（以下、PETと略称する。）延伸糸を用い、緯糸に得られた複合繊維を用いて平織り組織にて製織し、この生機を精練した後、100℃の沸水中で30分間処理し、次いで風乾して得た布帛について、10人のパネラーによる官能評価を実施した。緯方向に引っ張った時にストレッチ性を有し、かつ、高刚性があるソフトな風合であると判断した人数で評価を行い、○及び△を合格基準とした。

9人以上：○、7～8人：△、6人以下：×

(5) 総合評価

上記した各評価項目を考慮して総合的に○、△、×で評価し、○及び△を合格基準とした。

【0018】実施例1

酸化チタンを0.4重量%含有し、極限粘度が1.01の高粘度側PTT(A)と、酸化チタンを0.4重量%含有し、極限粘度が0.78の低粘度側PTT(B)を夫々熔融し、24孔で孔径0.6mmの丸断面形状孔を有する同一紡糸口金から繊維横断面のPTT(A)と(B)の容積比が1:1になるように吐出比を調整して260℃の紡糸温度で紡出した。

【0019】次いで、紡出糸条を空気流で冷却固化した後、0.7重量%の油剤を付与し、糸条を2分割して2800m/分の速度で引き取り、82.5デニールのサイドバイサイド型の半未延伸糸を得た。なお、この時の吐出量は、延伸後の繊維度が50デニールになるように調整した。次いで、得られた半未延伸糸を70℃で1.65倍に延伸した後、160℃のホットプレート上で熱処理を行い、50デニール/12フィラメントの複合繊維を得た。

【0020】実施例2～3、比較例1～2

繊維横断面における d_e/c_d を変更するために、表1で示したようにPTT(B)の極限粘度を変更した以外は、実施例1と同様にして複合繊維を製造した。

【0021】実施例4、比較例3

d_e/c_d を変更するために、PTT(A)に第3成分として2,2-ビス{4-(β-ヒドロキシ)フェニル}プロパンのエチレンオキシド付加体を実施例4は5*

*モル%、比較例3は2モル%共重合し、PTT(B)との間に表1で示したような極限粘度差を付けた以外は、実施例1と同様にして複合繊維マルチフィラメントを製造した。

【0022】比較例4

酸化チタンを0.4重量%含有し、極限粘度が0.67の高粘度側PET(A)と、酸化チタンを0.4重量%含有し、極限粘度が0.46の低粘度側PTT(B)を夫々熔融し、24孔で孔径0.8mmの丸断面形状孔を有する同一紡糸口金から繊維横断面のPET(A)と(B)の容積比が1:1になるように吐出比を調整して295℃の紡糸温度で紡出した。

【0023】次いで、紡出糸条を空気流で冷却固化した後、0.7重量%の油剤を付与し、糸条を2分割して3300m/分の速度で引き取り、75デニールのサイドバイサイド型の半未延伸糸を得た。なお、この時の吐出量は、延伸後の繊維度が50デニールになるように調整した。さらに、得られた半未延伸糸を70℃で1.5倍に延伸し、次いで150℃のホットプレート上で熱処理を行い、50デニール/12フィラメントの複合繊維を得た。実施例1～4及び比較例1～4で得られた複合繊維マルチフィラメントの評価結果を併せて表1に示す。

【0024】

【表1】

	極限粘度		d_e / c_d	紡糸 操業性	ストレッチ 性と風 合い	ヤング率 (g/D)	撓縮率 (%)	総合評価
	A	B						
実施例 1	1.01	0.78	0.48	○	○	23.6	52.4	○
実施例 2	1.01	0.88	0.19	○	△	25.1	39.9	○
実施例 3	1.01	0.71	0.78	△	○	22.3	65.8	○
実施例 4	1.03	1.01	0.36	○	○	34.4	55.7	○
比較例 1	1.01	0.66	紡糸不可					×
比較例 2	1.01	0.98	0.04	○	×	26.1	22.6	×
比較例 3	1.03	1.01	0.03	○	×	30.7	40.6	×
比較例 4	0.67	0.46	0.54	○	×	50.3	44.7	×

【0025】表1から明らかなように、実施例1～4で 50 得られた複合繊維マルチフィラメントは、紡糸時の切糸

が少なく、これらの複合繊維マルチフィラメントを緯糸に配した熱処理後の織物は、緯方向にストレッチ性を有した嵩高性のあるソフトな風合であった。また、ストレッチ性の指標とした捲縮率も30%以上であり、さらには、ソフト感の指標としたヤング率も40g/D以下であり、布帛の官能評価との相関性が非常に大きいものであった。

【0026】一方、比較例1は、両ポリエステル製の極限粘度差が大きすぎるため、熔融紡糸時に吐出糸条が屈曲して口金面に付着し、紡糸が不可能であった。また、比較例2は、 de/cd が小さすぎるために捲縮の3次元クリンプ形態が小さくなり、織物に嵩高性が欠けており、捲縮率も低い値であった。次に、比較例3は、PTT(A)に第3成分を共重合しているために捲縮率は適当な値であったが、 de/cd が小さすぎるために捲縮の形態が小さくなり、織物に嵩高性が欠けていた。さらに、比較例4は、PETを用いているために織物の風合いが硬く、ソフト感のある織物は得られなかった。ま *

*た、ヤング率も40g/Dよりも高い値であった。

【0027】

【発明の効果】本発明によれば、製編織すれば、嵩高性に富み、従来にないソフトな風合を有するストレッチ性繊維となるストレッチ性繊維用ポリエステル複合繊維が提供される。

【図面の簡単な説明】

【図1】本発明のストレッチ性繊維用ポリエステル複合繊維の一実施態様を示す横断面図である。

10 【符号の説明】

- a 両ポリエステル接合面と繊維外周との接点。
- b 両ポリエステル接合面と繊維外周との接点。
- X 線分abの中心を通り、線分abに直交する直線。
- c 直線Xと高粘度側ポリエステルの繊維外周との交点。
- d 直線Xと両ポリエステル接合面との交点。
- e 線分abと直線Xとの交点。

【図1】

